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CURRENT ACTIVITIES

ATLANTIC PROVINCES

Occurrence of Ceratocystis ulmi (Buism.) C. Moreau in New Brunswick.—On November 21, 1957, it was definitely established that the causal fungus of Dutch elm disease had been obtained in culture from elm bark collected from one tree at Woodstock, N.B. during October. Although the advent of this disease in New Brunswick has been anticipated for some time this is the first known occurrence in that Province. It is not known how it may have been introduced. The nearest known cases of Dutch elm disease are about 55 miles distant in the State of Maine. Arrangements were immediately made to have the infected tree destroyed. At this time of the year, it is not practicable to carry on surveys for this disease but the Forest Biology and Plant Protection Divisions are co-operating in planning the work which must be undertaken next year.

ONTARIO

Comments on the Agents Responsible for the Cankering and Killing of Balsam Fir in Eastern Canada.—A pathological condition which has existed in balsam fir throughout eastern Canada for many years is manifested by the dying of branches, tops, and entire trees. It is accompanied by a striking and characteristic reddening of the needles and usually by a cankering at the base of the affected portion. Causes have been attributed by entomologists to the feeding of adult sawyer beetles and of woolly-aphid larvae and by pathologists to attack by one or another nominally saprophytic fungus. None of these reputed agents is, however, acceptable by itself as a causal organism. On the other hand, a comprehensive theory which has been evolved and which is being successfully tested, is considered to explain satisfactorily the dieback "disease" without necessarily rejecting any of the earlier theories. These are held to be incomplete rather than incorrect. Several fungi are believed capable of causing the "disease", but only when insect attacks or mechanical injuries provide them with means of entry into the trees.

One such fungus, *Thyronectria balsamea* (Cke. & Pk.) Seeler, which has been both widespread and abundant throughout Ontario for at least the last three years, has been proved capable of rapidly producing typical symptoms if introduced into surface injuries to twigs and stems. However, even with massive inoculation, it is only rarely able to enter intact tissue, and no symptoms have resulted from uninoculated injuries in any of 69 cases involving 14 young trees.

Two other fungi, *Dermea balsamea* (Pk.) Seav. and *Cytospora* sp., which are also associated with typical cankering and dieback, were found in 1957 to be nearly as widely distributed as *Thyronectria,* and in some cases to be even more abundant. They are currently being tested. A fourth putative canker-producer was found too recently to have been identified, and others may exist in Ontario at the present time. In the Maritime Provinces, *Fusicoccum abietinum* Prill. & Delacr. and *Valsa friesii* Duby have been reported recently in association with cankering of balsam (cf. Ann. Rept. of the Forest Insect and Disease Survey, 1956). The *Valsa* may be the perfect stage of the Ontario *Cytospora.*

On the insect side, proof is not yet as complete, but all of the evidence strongly supports the belief that various insects provide entry to the fungi by injuring the trees, carry inoculum to uninfected wounds, or both puncture and inoculate the trees.

In the case of the sawyer beetle (*Monochamus* spp.), for example, the writers had found the characteristic feeding scars of the adults to be commonly associated with typical dieback in every area visited for two seasons before they were aware that the injuries were caused by an insect. Angus Harnden, Forest Biology Ranger in the North Bay District, identified the nature of the scars immediately upon seeing them.

Isolations from twigs in which death was associated with *Monochamus* feeding have, on different occasions, produced *Thyronectria, Dermea,* and *Cytospora.* Furthermore, all three fungi tend to fruit abundantly and extensively on the smooth younger bark of dead trees when moisture is adequate, so it is likely that in many small trees the emerging beetles would immediately come into contact with fruiting bodies and their sticky spore-masses. The ability of beetles to inoculate wounds they cause or to produce symptoms without inoculation will be tested when they become available next spring.

That insect activities can stimulate hypertrophies in trees is well known. In the Maritimes, Balch (Studies of the Balsam Woolly Aphid, *Adelges Piceae* (Ratz.) and its Effects on Balsam Fir, *Abies Balsamea* (L.) Mill., Can. Dept. Agr. Pub. 867, 1952) showed that the feeding of woolly-aphid larvae caused "gout" disease and the slow dying of balsam which he attributed to a combination of factors particularly unfavourable to the trees. Opposing this interpretation is the fact that similar feeding on another host (cf. Haddow and Newman, A Disease of the Scots Pine caused by *Diplodia pinea* associated with the Pine Spittle-Bug, Trans. Roy. Can. Inst. 24(1): 1-17, 1942) was shown to result in disease symptoms only when the fungus was present. Balch, incidentally, reported the sporadic presence of *Creonectria cucurbitula,* a name which is synonymous with *T. balsamea.* In this connection, it should be pointed out that the fungi may fruit at the end of one season in the host or not until the following year.

Dying of foliage has also been observed in association with the empty galls of a needle midge (*Itonida balsamicola* (Lint.)) and with persistent cone-axils in some trees. This latter case suggests that puncture of intact cones by some insect such as the seed chalcid (*Megastigmus*) may constitute sufficient wounding to permit entry by a fungus.

Logging operations, road building, and other such tree-disturbing activities are very frequently followed by local upsurges in balsam dieback. They are accompanied, usually, by some damage to residual trees and, not infrequently, by residues of slash suitable for the reproduction of *Monochamus.* Mechanical injuries and uninoculated wounds caused by biological agents may very well become infected through the wandering about of non-injurious insects.

The only measure of defence from this "disease" which immediately suggests itself is sanitation by proper and prompt slash disposal in connection with woods operations.—F. L. Raymond and J. Reid.

A Fungus Associated with Blight and Dieback of Hybrid Aspen.—Throughout Ontario the progeny of *Populus alba* L. X *grandidentata* Mich. are severely attacked by a blight and dieback. This condition, with which an unidentified species of *Gloeosporium* is consistently associated, has not been observed on either parent. The importance of this disease is heightened by the economic potential of certain hybrid clones of this cross.

Disease symptoms appear in midsummer and consist of under-development, discoloration, curling, and necrosis of peripheral leaves on sporadic branches throughout the crown. Regeneration and larger trees seem to be equally affected. Orange "flags", clumps of diseased but still living leaves, clearly indicate the affected branches. Dead leaves acquire a deep chocolate-brown colour.

Although, in general, the symptoms suggest that the disease is caused by adverse physiological processes, large numbers of minute apothecia on the upper surface of wet, dead leaves are visible under moderate magnification. The apothecia, occurring between epidermis and cuticle, contain numerous, unbranched conidiophores each bearing a single hyaline, oval conidium with average dimensions of $7.0\mu \times 3.3\mu$ ($4.1 - 10.7\mu \times 2.5 - 4.9\mu$). Wide hyphae occur within the cells of epidermal, palisade, and mesophyll tissues. The intracellular occurrence of the mycelium and the fact that disease symptoms appear only after foliar growth of the host is well advanced suggests that the fungus is a highly specialized parasite and the most probable cause of the blight on these hybrids. In September, perithecial initials

are detectable in the mesophyll of dead leaves but the asci do not mature until the following May. The identity of this ascomycete is tentatively taken to be *Gnomonia*.

Different clones exhibited different degrees of susceptibility to this disease; hence, the prospect of overcoming this blight appears to be favourable.—B. W. Dance.

PRAIRIE PROVINCES

Partial Breakage of Dormancy in Birch Seeds by Gibberellin.—The combined effect of darkness and low temperature (below 20°C.) is known to inhibit the germination of non-stratified seed of certain species of *Betula*. Several chemicals have been tried to overcome such dormancy. The results so far have been negative with one exception. This is gibberellin which recently has shown various growth stimulating effects in many experiments.

The gibberellin used was potassium salt of gibberellic acid, manufactured by Merck Co. with the trade name Gibrel. This salt was incorporated at various concentrations in the germination media of 1 per cent agar in tap water in petri dishes. Tersan 75 fungicide was also added at 50 p.p.m. to suppress any fungal growth. The dishes were sown with seed of white birch (*B. papyrifera* Marsh.) and water birch (*B. occidentalis* Hook.). The seeds were kept in darkness at 13°C. for 10 weeks, after which the germination was recorded. Then the dishes were transferred under lights at room temperature where the germination was completed in 1 to 2 weeks. The following table shows the percentages of the germination that took place in darkness at 13°C. with various concentrations of gibberellin (p.p.m.):

	250	50	25	5	2.5	0.5	.12	0
B. papyrifera	13	4	6	0	2	0	0	0
B. occidentalis	96	83	50	33	32	36	20	11

The concentration of gibberellin was not critical. This has been found in other studies with this chemical, and is in contrast to the effects of auxins, which are toxic at high concentrations. Search in the extensive literature concerning effects of chemicals on seed germination revealed only one result comparable to the 85 per cent increase for *B. occidentalis* with gibberellin at 250 p.p.m. This result was obtained with gibberellin and lettuce seed. Various other chemicals, e.g. thiourea and related compounds, have been reported to stimulate germination, but only to a much less degree than above. Germination of birch and lettuce seeds can also be stimulated with red light, but the physiology of this phenomenon is not known. The analogical stimulation with a chemical may help to discover the nature of the stimulation with light.—O. Vaartaja.

The Brown Elm Scale, Lecanium corni Bouché.—This scale was very abundant on American elm trees in Regina, Sask., during the 1957 season. It had been present in the city for many years previously but only in insignificant numbers. The scale overwintered as partly-grown nymphs under loose bark and in crevices on the branches and trunks. Winter survival was high as the nymphs were present in great masses in the spring. It is possible that the above-normal temperatures during the winter of 1956-1957 may have increased survival. This scale occurred also on green ash and on Manitoba maple, but only in relatively small numbers.

By April 4 many of the hibernating nymphs were active and in the process of establishing themselves on the smaller branches and twigs; by early May many were becoming full grown. Population density counts yielded approximately 10 living scales per linear inch of twig. By June 6 approximately 10 per cent of the females had laid some eggs and already the twigs and branches were wet, sticky, and darkly discoloured with the secretion from the females. Hatching began in early July and was completed before July 18. By late July a new generation of nymphs had moved to the leaves. Many individuals were already large, flattened, and lime-yellow in colour. The remainder were small and dark yellow in colour; some of these were still moving about actively. In the samples taken on the foliage and totalling more than 25,000 scales, 90 per cent of the population was found on the lower surface of the leaves. Parasitism of the scale occurred but was not appraised.

Because of the abundance of the brown elm scale, the unsightliness of the infested elm trees, and the damage which the scale seemed to be causing to the smaller branches and twigs, chemical control was attempted by the Regina City Parks Department. In early May, after the overwintered nymphs were established on the twigs but before the leaves had developed, a spray containing two pints of malathion 50 per cent emulsion per 100 gallons of water was applied to the trunks and branches. This treatment proved ineffective.

In mid July and August, control tests were undertaken by the Entomology Section, Forest Nursery Station, Indian Head. Lime sulphur and malathion emulsion were applied as foliar sprays against the nymphs. The treatments made and the observations recorded are shown in the following summary. 'Per cent mortality', was calculated, using Abbott's formula (Abbott, W. S.—A method of computing the Effectiveness of an Insecticide. Jour. Econ. Ent. 18: 265-267: 1925).—Lloyd O. T. Peterson, Forest Nursery Station, Experimental Farms Service, Indian Head, Sask.

INSECTICIDE FORMULATION AND AMOUNT PER 100 GALLONS WATER

—	Check (Unsprayed)	Dry lime sulphur 8.3 lbs.	Malathion 50% emulsion 2 pt.	Malathion 50% emulsion 4 pt.	Date examined
Date of treatment July 18					
Leaves examined	15	10	15	12	July 23
Scales present	1194	1559	1365	1397	
Per cent alive	92.0	64.9	7.8	1.4	
Per cent mortality	....	29.4	91.5	98.5	
Leaves examined	13	10	20	10	July 31
Scales present	1947	2895	1005	1046	
Per cent alive	92.7	83.1	2.5	18.1	
Per cent mortality	....	10.4	97.3	80.5	
Leaves examined	22	11	22	18	
Scales present	1079	1091	1255	1282	
Per cent alive	86.5	71.2	12.9	15.8	
Per cent mortality	....	17.7	85.1	81.7	
Date of treatment August 19					
Leaves examined	12				August 19
Scales present	4144				
Per cent alive	92.9				
Leaves examined	6	6	10	6	September 9
Scales present	1488	897	1057	1296	
Per cent alive	58.8	33.6	4.3	1.0	
Per cent mortality	....	42.8	92.7	98.3	

ROCKY MOUNTAIN REGION

Correction.—In Vol. 13 No. 5, page 2, top line of column 2, "15.5%" should be "14.5%". Also in Table II in same column, "<14.5 per cent" should be ">14.5 per cent".

ROCKY MOUNTAIN REGION

Antagonism by Coryne sarcoides (Jacq.) Tul.—Recent preliminary studies have indicated that certain strains of *Coryne sarcoides*, a non-decay-producing ascomycetous fungus, are antagonistic to wood-destroying fungi on malt agar and on wood. Because of the wide-spread occurrence of this fungus on living conifers and its frequent association with heartrot fungi, it was of interest to determine the incidence of actively antagonistic strains in a larger sample.

A total of 79 isolates of this fungus were screened for the occurrence of strains antagonistic to *Coniophora puteana* (Schum. ex Fr.) Karst., a brown rot fungus, and *Peniophora septentrionalis* Laurila, a white rot fungus. These isolates comprised 21 from lodgepole pine, 49 from white spruce, and 1 from balsam fir in Canada, together with 8 isolates from various hosts in Britain. The tests were carried out by placing an agar plug from an actively growing culture of the wood-destroying fungus at one edge of a petri dish containing 20 ml. of 2% malt extract agar. A spore suspension of *C. sarcoides* was streaked on the opposite side of the plate at a distance of about 6 cm. Observations were made on the mutual effects of the growth of the two colonies at the end of 1, 2, 3, and 4 weeks. Table I records the interaction of the fungi after 4 weeks. The interaction was determined by the ability of various strains of *C. sarcoides* to inhibit the growth of the wood-destroying fungi at the point of contact of the colonies.

TABLE I

ANTAGONISTIC ACTIVITY OF *Coryne sarcoides*

Origin of Isolates	No. of isolates	Antagonism: Against *C. puteana* No.	Against *C. puteana* %	Against *P. septentrionalis* No.	Against *P. septentrionalis* %
Canadian Isolates	71	8	11.3	27	38.0
Lodgepole pine	21	2	9.5	21	100.0
White spruce	49	5	10.2	5	10.2
Balsam fir	1	1	100.0	1	100.0
British Isolates	8	7	87.5	7	87.5
Totals	79	15	19.0	34	43.0

These results largely agree with those of a previous investigation when tests were made with fewer isolates. The highest number of active strains occurred among the British isolates which were equally effective against both the white and brown rot fungus. It is noteworthy that all the Canadian isolates of *C. sarcoides* which came from lodgepole pine were effective against *P. septentrionalis,* a fungus which is unknown on living lodgepole pine but which frequently occurs on white spruce.

The results indicate that there is extreme variability in antagonism among isolates of this fungus, and that there can be specificity in the inhibitory action against certain fungi. Although the fungus appears unlikely to assume importance as a factor in the development of decay because of the relatively limited occurrence of active strains, the knowledge that such interactions may occur between fungi in the heartwood should contribute to a better understanding of factors that determine fungal succession in trees.—D. E. Etheridge and Elizabeth Carmichael.

BRITISH COLUMBIA

A Comparison of Insect Species on Pole Blighted and Healthy Western White Pine, Pinus monticola Dougl.—During the summer of 1956 a study was carried out on white pine in the Arrow Lakes and Slocan Lake region of the Nelson Forest District of British Columbia. The object was to find out what insect species were associated with pole blighted and healthy white pine trees.

Eighteen healthy and 18 pole blighted trees were selected for sampling in four different plots. In each of three pole blighted areas, Makinson Flats, Fosthall, and Silverton, six pole blighted trees and three healthy trees were selected; in one non-affected area, Caribou Creek, nine healthy trees were selected. Samples, each consisting of four foliage-bearing twigs, were taken from each tree at upper-, mid-, and lower-crown levels. Four samples were taken at each level making a total of 12 samples per tree. Each foliage sample was placed in a paper bag and examined in the laboratory for insects. The bark was also examined for insects when foliage samples were taken. Sampling was carried out (1) May 23 to June 29, (2) July 6 to August 1, (3) August 9 to September 10. Where regeneration trees were growing near the plots, beating samples were taken. Root crowns of all sample trees were exposed and examined for insects and insect damage.

The average number of insects from foliage samples per pole blighted tree totalled for the three samplings ranged from 52 in the plot at Silverton to 83 in the Fosthall plot. The average per tree for all pole blighted trees was 67.

Root examinations showed that seven of the 18 sample pole blighted trees were damaged by *Hylobius* larvae. Damage was not severe in any of the root crowns and was usually restricted to cambial damage in root crotches; no root crowns were completely girdled.

The average number of insects collected per healthy tree ranged from 48 at Caribou Creek to 83 at Fosthall. The average for all healthy trees was 66.

Root crowns of healthy trees were damaged by *Hylobius* in the same ratio as pole blighted trees, i.e., seven infested to eleven uninfested. Fifty-three other healthy trees ranging in size from 0.5 in. to 20 in. D.B.H. were examined for damage to root crowns. Fifteen of these trees suffered damage from *Hylobius* ranging from slight to severe. The severe cases were small trees which had their root crowns completely girdled.

Ninety species of insects and mites were taken from white pine trees. Forty-two of these occurred on pole blighted trees, 46 on healthy trees in areas affected with pole blight, and 36 on healthy trees in unaffected areas. Nineteen species were found only on pole blighted trees, 18 only on healthy trees in affected areas, and 21 only on healthy trees in unaffected areas. Six species occurred in all three categories.

The data obtained do not provide conclusive evidence on the extent to which insects and mites are responsible for or associated with the pole blight condition. A comparison of the number and kind of insects and mites occurring on pole blighted trees with unaffected trees and areas suggests that they do not contribute directly to the condition by their feeding activities. Some of the species found only on pole blighted trees or in pole blighted areas might conceivably be linked with the condition as vectors. However, further study at this time of the invertebrate fauna in relation to this problem is not likely to yield information that will contribute to its solution.—A. F. Hedlin.

A preliminary Study of the Deposition and Early Growth of Fungus within the Galleries of the Ambrosia Beetle Trypodendron lineatum (Oliv.).—Recently, the means by which certain ambrosia beetles, including *T. lineatum,* carry the spores of their fungus from one gallery to another, and the location of dermal glands associated with fungus transport, have been described by Francke-Grosmann (Z. Morph. u. Ökol. Tiere, 45: 275-308. 1956). There are, however, several aspects of the initial deposit and growth of ambrosia fungus which remain to be clarified. A study of the location and nature of early fungus deposits in developing galleries of *T. lineatum* was started at the Victoria Laboratory in the spring of 1957.

A portion of a Douglas-fir log attacked by beetles April 28 and 29 was brought into the Laboratory and blocks containing developing galleries were cut out at 9-, 12-, 16-, and 33-day intervals. The blocks were fixed in FAA (Formalin-Aceto-Alcohol) solution, using reduced pressure, and 40 micron transverse sections cut through the galleries. The sections were stained with 1 per cent aqueous Safranin, counter-stained with saturated Picro-anilin blue and mounted.

A study of slides representing 18 galleries revealed the following picture. Nine-day galleries showed a completed vertical or radial entrance portion and the start of both horizontal branches, the longest of which was 11 mm. in length. Small clumps (one to seven per section) of blue-staining material, containing spore-like structures identical in appearance with those taken from the prothoracic dermal glands of *Trypodendron* were found on the gallery walls at irregular intervals. This material was often packed into wood cells (almost exclusively spring wood) which had been opened during gallery construction.

In 12-day galleries the small fungus deposits were more frequently found. They occurred only occasionally in the vertical portion of the gallery, being far more common in the two horizontal branches. Some of the fungus cells had started to elongate and grow, and slight aerial extensions into the gallery occurred. Also, some growth of hyphae into the wood was in evidence.

In 16-day galleries the fungus had definitely started to spread along the walls, although there was still much of the wood surface not overgrown. Fungus hyphae had penetrated as much as two or three cell thicknesses into the wood. Wood cells in which the fungus was originally packed were full of hyphae but these had not yet penetrated the thicker cell walls of the summer wood. The fungus growth, coloured entirely blue in previous stages, was now partly reddish-brown.

The 33-day galleries, in which the longest horizontal branches were over 32 mm. in length, showed an almost continuous lining of fungus, including much of the radial entrance portion. The hyphae had penetrated both spring and summer wood cells profusely. The older fungus appeared black to muddy brown in colour although younger growth was still blue.

The above observations indicate that the ambrosia fungus is deposited by *T. lineatum* at a number of scattered points within a gallery during its construction. This fungus thus has a good opportunity to become established quickly. The presence of many initial deposits of fungus in open wood cells, their occurrence with much greater frequency in the branches than in the entrance portion of the gallery, and their apparent increase in number in parts of the gallery already excavated, all suggest that the deposition process may be under control of the beetles and not due merely to the physical exertion of burrowing.—S. H. Farris and J. A. Chapman.

A Case of Nematode Infection in the Western Tent Caterpillar.—Reports of parasitism of Lepidoptera by nematodes are rare. The only record to come to the authors' attention was of a late-instar larva of *Malacosoma pluviale* Dyar in the summer of 1955. This larva was one of two live and four dead specimens collected at Toba River, about 45 miles north of Powell River, B.C., which were submitted for disease diagnosis. Two live larvae were placed in a rearing container with suitable food. Six days later both larvae were dead and one of them had what appeared to be several extraordinarily long nematodes extending in a coiled fashion from a hole in the integument. In all, four nematodes were extracted from this one location on the body. They were easily removed intact by means of forceps. No worms were recovered from other regions of the body cavity or in the other specimens of the same collection.

The nematodes were identified by Dr. M. A. Khan as larvae of the family Mermithidae. They are long, slender, and cream coloured, with no obvious external or internal morphological features. They vary in length from 13.5 to 16.0 centimetres. The average width of the mid region of the body is about 0.5 mm.

Nematode infections in *M. pluviale,* or other forest Lepidoptera, do not appear to be important biological control agents judging from the extremely low incidence of their occurrence. While rarity of cases makes records such as the

above noteworthy, these parasites should also be regarded as potential sources of interesting and profitable investigation.—S. M. Sager and M. J. Bassett.

Heavy Damage to Chinese Junipers, Juniperus chinensis L., associated with Pestalotia funerea Desm.—During the summer of 1957 most of 200 Chinese junipers in a Victoria nursery, consisting of prostrate forms 2 feet or more wide and erect forms 2 to 3 feet tall, were severely damaged. Lesions, many of them girdling, were observed on twigs, on main stems at ground level, and on main branches of prostrate forms where they touched the ground. Examination by Mr. G. S. Brown, Plant Protection Division, Victoria, failed to reveal any evidence of entomological association.

Attempts were made to isolate and identify fungi from the lesions. Twelve sections, 10 to 20 mm. in diameter by approximately 150 mm. long, were taken from diseased tops of different plants and incubated in a humid atmosphere under bell-jars. After a week of incubation, spore tendrils extruded from places on all sections. The spores coming from 11 sections were characteristic of *Pestalotia funerea* Desm., although tendrils of Macrophoma-like spores were also found on one of the eleven. The spores extruding from the twelfth section belonged to *Monochaetia* sp.

From two root systems similarly incubated, only Mucoraceae developed. Cultures obtained from excised bits of dead inner bark taken from above—and below—ground parts of ten junipers were of several kinds, including *Pestalotia funerea* from three of the ten trees. Rots that developed in ten apples inoculated with soil taken from near the juniper roots were associated with *Pythium* sp. in eight apples and *Pestalotia* sp. in two apples.

It is believed that *P. funerea* caused the symptoms observed. At the affected nursery, *P. funerea* is associated with commonly occurring tip-blight of junipers and other Cupressineae, so that inoculum is frequently abundant. The attack reported here is noteworthy because the fungus, a weak pathogen that is rarely evident on stems or branches 7 mm. or more thick at point of infection, was associated with large lesions on main branches or stems of Chinese juniper. Predisposition to infection by weakness or injury is suspected. In 1956 severe damage, consisting of girdling at ground-level, had been noted on less than 20 erect junipers. Although *P. funerea* was among the fungi that had been isolated from those trees, the damage had been attributed, in part, to the November 11th, 1955, frost.—P. J. Salisbury.

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